while the winters, though cold, are dry and healthful, like those of Canada. Three-fourths of the island is covered with dense pine forests. In the north are also the larch and birch, while in the south are the maple, oak, ash, bamboo, corktree, and other sub-tropical trees or shrubs. The fauna includes the bear, fox, sable, wolves, reindeer, and the small striped squirrel of northern India, while in the rivers or along parts of the coast seal, salmon, and more southern fish abound. The spouting of Greenland whales is no uncommon sight on the coast washed by the Okhotsk Sea.

The total number of inhabitants is about 36,000, of whom only 4,000 are natives. Nearly all the present white population consists of convicts and Russian officials and soldiers. The Russians are for the most part confined to two districts—one around Alexandrovsk on the west coast, and the other around Khorsakovsk on Aniva Bay in the extreme south of the island. A few settlements are scattered up and down outside these areas, but the principal prisons are at Alexandrovsk and Khorsakovsk, with a large sub-prison at Rikovsk east of Alexandrovsk.

The native population is composed of about 2,000 Gilyaks, 1,300 Ainus, 750 Orotchons, and 200 Tungus. Scanty though the population is for the size of the island, Sakhalin has no lack of resources, vegetable, animal, and mineral. The coal of the Dui-Alexandrovsk mines has been worked for many years, and gold and other metals occur at many points, though an obstacle in the way of mining is the fact that in the northern forests the soil is frozen below a depth of four feet the year around.

Mr. Dalton expresses the view that the annexation of the southern part of the island by Japan will materially benefit the country, as it means that the convict settlement there will be abolished; and as the convicts have had no interest in promoting the development of the island's resources, Sakhalin has not been helped by their presence.

UNIFORMITY IN MOUNTAIN ELEVATIONS.

BY

PROF. ANGELO HEILPRIN.

In a paper entitled "The Accordance of Summit Levels among Alpine Mountains," and published in the *Journal of Geology* for February-March, 1905, Mr. Reginald A. Daly presents some interesting considerations bearing upon one of the most obscure of geo-

graphical problems, and much side-light (or thought) upon the theory of peneplanation as it is brought in to explain the phenomena which he discusses. It cannot, perhaps, be said that Mr. Daly fully responds to or satisfactorily meets all the problems which he himself propounds, but that he successfully sets to side a theory or doctrine in geology which has become more than popular with the "newer school" of physiographers many will agree.

The facts to which the author refers have long been known to students of mountain-forms, and, perhaps, equally so to the mountaineer, who sees in Nature naught but "the beauties of Nature," and in whose broader contemplation theoretical conceptions have no part. The problem as to why the dominant summits in a given mountain chain or system are so nearly of a uniform height manifestly attaches itself directly to the theory of peneplanation, since it reflects, although in a less trenchant way, the problem of even crest-lines, such as is typified in the long N. E.-S. W. extent of the Appalachian system of mountains. In other words, the lofty mountain summits are residual masses standing out from an eroded and formerly even-topped (or peneplanated) land-surface, and their tip-tops point in a general way to the upper horizon from which they have been cut.

Mr. Daly, in weighing the evidence, finds that the conditions of peneplanation do not satisfy the problem. An important consideration with him in arriving at the conclusion is the necessity for assuming that the condition of peneplanation must have been followed precedent to the new erosion by a warping (with medial upthrust) of the land's surface, so as to bring about that "low arch, highest in the interior of the range and elongated in the direction of the main structural axis of the range" which is thought to mark the "imaginary surface which will include the higher summits of peaks and ridges in an Alpine range."

But one may well pause here and ask: Has the imaginary surface which unites the culminating points of an Alpine chain really this form of an arch? Were the Alps, or the Pyrenees, or the Caucasus alone considered one might be tempted to answer in the affirmative; but when the broader prospect of the nearly 1,500 miles' extent of the Rocky Mountains, between Mount Columbia and the Sierra Blanca, with its hundreds of summits rising to the 12,000-14,000 foot level, is opened up; or the equally long line of the Himalaya-Karakorum system—with its loftiest elevation, Mount Everest (29,002 feet), far toward its eastern part separated by a thousand miles or more from its "second in line," Mount Godwin-Austen (or

Peak K^2, 28,278 feet)—be considered; or the still more formidable chain or cordilleras of the Andes, with summits rising from 19,000 to 22,000 feet distributed irregularly over a course of 3,000 miles or more, it is only with a feeling that the imagination has been geographically stretched that we can consider the theoretical arch to exist. In so far, therefore, an objection to the theory of peneplanation—to the extent, at least, that it necessitates the condition of warping—might be considered removed. Probably a far more serious objection to the theory in this connection is the condition itself that residual fragments of a peneplanated surface should remain of so nearly uniform elevation of whatever physical type the constructing form may be, after erosion had removed (or lowered) the general surface by many thousand feet. The student of geological physics who has not yet been completely won over to the doctrine of peneplanation may, indeed, ask for much stronger evidence than has yet been presented proving the kind and measure of land-wear that is demanded by this theory before he will be willing to relinquish the consideration of other explanations that seem to meet his problems equally well, and he will, perhaps, hardly be on the outside of the science if he still entertains a suspicion that even the lower eroded surface representing the even crest-lines of the Appalachian Mountains need not necessarily be the expression of peneplanation.

Without entering into a further discussion of this theory and of its consequent conditions, or following too closely the speculative views of Mr. Daly, it is interesting to note that our author finds a safer ground in the analysis of his problem in assuming that his isometric summits are such largely (or mainly?) by inheritance (from an "original" top-line of development), or, more exactly, inheritance modified by isostatic adjustments and differential degradation.

In assuming this hypothesis, Mr. Daly relies, perhaps too much, upon the theory (set forth by himself) that a constructional limit to the height of a mountain can be predicated, and that this ultimate height is determined by the resistance of the mass to a crushing strain. In other words, Nature, in making mountains, permits them to rise to a certain elevation and no more, and this farthest elevation will be the even measure whence the departure from inheritance must be calculated. But have we any evidence in fact to support this conclusion? Mr. Daly believes that no mountain is likely to have ever risen to a much greater height than 30,000 feet or to have greatly overtopped Mount Everest. It may be admitted at once that there is no evidence of any kind to support this conclusion,

unless, indeed, one assumes the wholly illogical position that *because* the loftiest summit to-day rises to 29,000 feet it necessarily represents the limits of work in this direction. It might as well have been argued in 1750 that this limit of resistance to crushing strain was the Peak of Teneriffe (then thought to be the highest mountain in the world) and, a quarter of a century later, the Mont Blanc; and still later Chimborazo.

While Mr. Daly's paper deals exclusively with isometry among Alpine summits, and the discussion there given is seemingly made to contour the full problem which it attaches, the fact is that the problem is made much more complex by reason of the condition that accordance in summit elevation (or isometry) is as much a distinctive feature of low mountain chains as of high ones, and in those of antiquity as of new age. One need hardly call to mind (without reference to any theory regarding such formation) the familiar Azoic and, later, Paleozoic stems of the Appalachian system; the 1,500-mile length of Permo-Carboniferous Ural Mountains, with culminating points in the north and in the south of 5,200-5,500 feet; the Jurassic Jura Mountains, and the great Cretaceo-Tertiary involuted Carpathian-Balkan uplift, with its numerous summits of 7,800-8,600 feet elevation scattered over a length of 1,200 miles or more. Other examples of similarly-adjusted mountains could be cited, and a conspicuous reference would be the east-coast mountains of Australia or the Great Dividing Range, with its various ramifications and parallel spurs, in the farther southwest. A most interesting element in the problem under consideration, and one that opens up entirely new vistas in speculation, is the condition that even among *volcanic* mountains of comparatively recent date and where the volcanic form is still retained, there is frequently a marked correspondence in summit-levels for given series. It would be entirely beyond the bounds of this paper to enter into a discussion of this most interesting disposition of Nature's forces, but it may not be amiss to call attention to that remarkable linear group which constitutes the major part of the Lesser Antilles, and gives to the different islands (St. Kitts, Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent, etc.), stretched out over a length of 600-700 miles or more, the extraordinarily accordant summits of 3,500-4,200 feet elevation.

The problem of mountain reliefs and adjustments does not seem to the writer to lend itself so readily to approach and resolution as many other problems in geology, and a caution for facts in advance of theories could hardly be thought to retard the study of this most fascinating department of terrestrial physics.